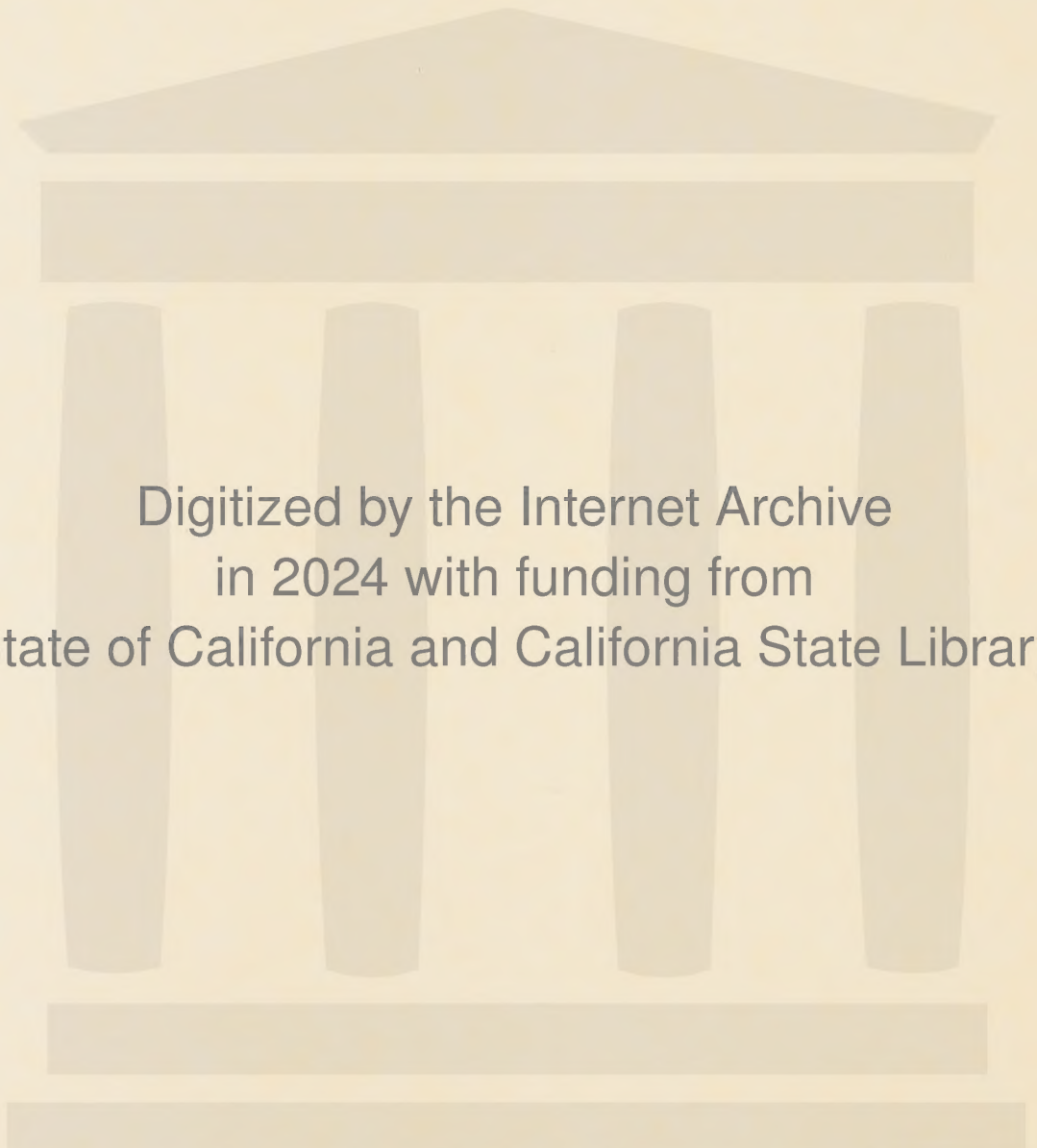
Ventura County (Calif.). Planning Division.

Seismic & safety element : summary. [1974]



SEISMIC SAFETY

SEISMIC & SAFETY ELEMENT

SUMMARY

SEISMIC SAFETY

INTRODUCTION

In 1971 the California Legislature passed legislation that required two new elements to be added to the General Plans of all cities and counties in the state, and that they be adopted by September 20, 1974. These were the Safety Element and the Seismic Safety Element. The impetus for this legislation was a series of natural disasters which had occurred in Southern California during the preceding two years. Considerable property damage and loss of life ensued from the 1969 floods, a series of disastrous fires which broke out in the fall of 1970, and landslides which occurred the following winter on slopes denuded by the fires.

The impetus for the Safety Element was the San Fernando Valley earthquake of February, 1971, whose results pointed out major deficiencies in building design and land use planning; prompted the Legislature to require the second element to the General Plan, a Seismic Safety Element which elaborates upon the geologic requirements of the Safety Element. Government Code Section 65302 (f) requires this Seismic Safety Element to include identification and appraisal of such hazards as fault rupture, ground shaking, seismically induced waves, mudslides, landslides, and slope stability.

Because of the confused and overlapping nature of the mandated Seismic Safety and Safety Elements, it was decided by the county to merge the two into one integrated discussion of hazards (as recommended by the State General Plan Guidelines), hereafter referred to as the Seismic and Safety Element. The preparation of the Seismic and Safety Element is a uniquely coordinated effort between the County of Ventura and the nine cities.

It was felt that since most of the hazards are regional rather than local in scope, a general county-wide treatment of each hazard would be more valuable than ten separate, locally oriented elements. Each hazard is therefore discussed from a comprehensive, regional standpoint, prior to being examined at the local level. In this way each entity will share the important regional discussion of the hazard as well as receive an individualized document that speaks to the particular circumstances within its own jurisdiction.

Apart from meeting the requirements of State law, a number of goals have been achieved by preparing the Seismic and Safety Element. As mentioned above, a more regional, integrated picture of hazardous conditions within Ventura County has been evolved. This information has been collected and presented in a form which allows decision makers and the public to quickly evaluate the pertinent aspects of a given hazard. In conjunction with information describing the hazards themselves, a range of response measures has been offered from which decision makers may choose, as they attempt to alleviate a given hazard. Lastly, a framework of analysis has been provided to aid future investigation in the county of all types of hazards and the resources they impact.

FAULT DISPLACEMENT HAZARD

Description

The earth is laced with faults - planes or surfaces in earth materials along which failure has occurred and materials on opposite sides have moved relative to one another in response to the accumulation of stress. Most of these faults have not moved for hundreds of thousands or even millions of years and thus can be considered inactive. Others, however, have moved sufficiently recently to be considered active, i.e. capable of displacement in the near future. Any fault movement beneath a building in excess of an inch or two could have catastrophic effects on the structure, depending upon its experiences at the same time. Therefore it is important to know not only which faults may move but how they might move.

The definition of what consitutes an "active fault" may vary greatly according to the type of land use contemplated or to the importance of the structure. Commonly, faults are regarded as active and of concern to land-use planning when there is evidence that they have moved during historic time or, through geologic evidence, there may be a significant likelihood that they will move during the projected use of a particular structure or piece of land. Some faults labeled as inactive are so termed due to lack of knowledge. Increased research and monitoring of these faults could reveal some of them as active.

The amount of displacement that can occur during a single earthquake can be related in a general way to the total length of a fault. Major faults that commonly produce significant displacement often have related branches that diverge from, or lie nearby, the main line, but usually have less movement along them. In addition to the location and amount of displacement, the type of movement is extremely important in estimating the amount and type of damage that might be produced. For example, lateral movement is probably less potentially damaging than verticle (thrust) displacement.

Not all surface faulting need be rapid nor need it occur during major earthquakes. Imperceptibly slow movement, called "fault creep," may occur continuously over time. Similarly, not all deformation of the earth's surface produces fault displacements. In many cases, plastic deformation, or bending, of surface rocks may accompany stress, and can damage or destroy structures.

The greatest potential for fault activity is along any of the faults which lie within the several major fault systems which transect the county from east to west.

Effects

Nearly all man-made structures, such as houses, buildings, roads, bridges and pipelines, are susceptible to damage ranging from severe to total when affected by displacement along faults passing beneath their foundations. Only massive earth structures such as earthfill dams can be designed to remain functional after several feet of fault displacement along an underlying fault. Permanent effects of surface displacement along faults can also include abrupt elevation of depression of ground surfaces, disruption of surface drainage, changes in groundwater levels in wells and blockage and surface seepage of groundwater flow, changes in survey benchmark elevations, dislocations of street alignments and property lines, and displacement of drainage channels and drains.

The secondary effects of the hazard could include disruption of movement along roadways due to abrupt depression or elevations of pavement surfaces, flooding due to disruption of drainage channel and storm drain flow, and disruption of utility services such as water, gas, fuel, telephone and electric power lines.

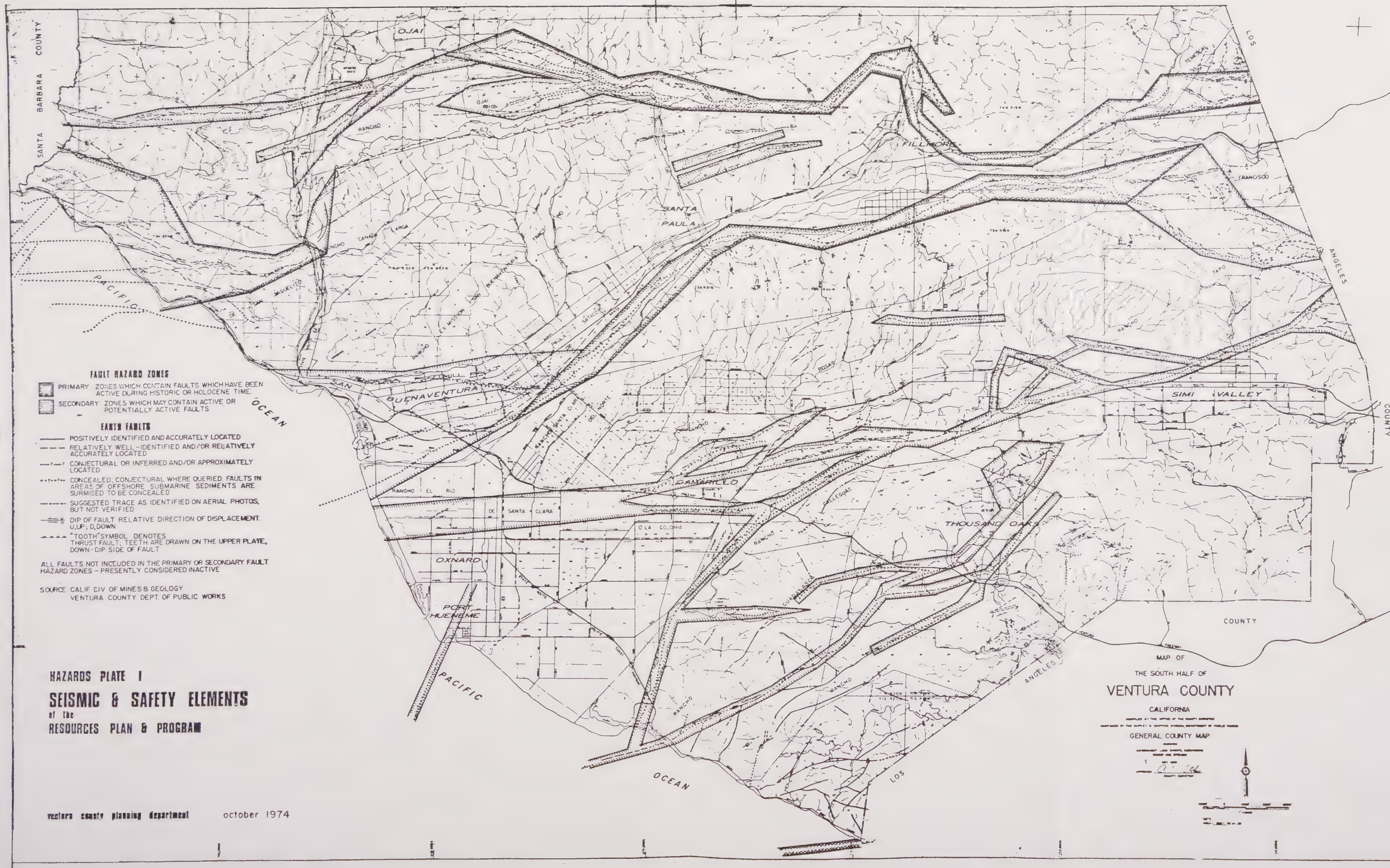
Alleviation of the hazard is largely accomplished through land use controls, geologic and engineering studies of prospective developments and the employment of design and engineering standards called for by preliminary studies.

Findings

Available geologic information indicates that the potential for the occurrence of surface displacement along one or more of the major east-west trending faults within the county and within the life of existing structures is high compared to the potential hazard statewide. Little is known of the recency of past movement along most of the fault within the county or whether any related fault branches may be present. Major development along most of the east-west faults within the county should be carefully considered until such time that adequate information is available to conclude that such faults are not active or potentially active.

In the event of surface displacement along a fault transecting one of the urbanized or industrialized areas of the county, loss of life and property could be significant depending upon where the displacement was located. Further development along faults will increase the likihood that someday fault displacement could affect development.

Present information is not considered sufficiently accurate to allow special investigation for most existing structures. Further, more detailed information on fault locations may indicate that further evaluation of some existing strucutres, particularly around facilities, could be warranted.



FAULT HAZARD ZONES

PRIMARY: ZONES WHICH CONTAIN FAULTS WHICH HAVE BEEN ACTIVE DURING HISTORIC OR HOLOCENE TIME.

SECONDARY: ZONES WHICH MAY CONTAIN ACTIVE OR POTENTIALLY ACTIVE FAULTS

EARTH FAULTS

- POSITIVELY IDENTIFIED AND ACCURATELY LOCATED
- RELATIVELY WELL-IDENTIFIED AND/OR RELATIVELY ACCURATELY LOCATED
- CONJECTURAL OR INFERRED AND/OR APPROXIMATELY LOCATED
- CONCEALED; CONJECTURAL WHERE QUERIED. FAULTS IN AREAS OF OFFSHORE SUBMARINE SEDIMENTS ARE SURMISED TO BE CONCEALED
- SUGGESTED TRACE AS IDENTIFIED ON AERIAL PHOTOS, BUT NOT VERIFIED
- DIP OF FAULT. RELATIVE DIRECTION OF DISPLACEMENT. U, UP; D, DOWN
- "TOOTH" SYMBOL DENOTES THRUST FAULT; TEETH ARE DRAWN ON THE UPPER PLATE, DOWN-DIP SIDE OF FAULT

ALL FAULTS NOT INCLUDED IN THE PRIMARY OR SECONDARY FAULT HAZARD ZONES – PRESENTLY CONSIDERED INACTIVE

SOURCE: CALIF. DIV. OF MINES & GEOLOGY
VENTURA COUNTY DEPT. OF PUBLIC WORKS

HAZARDS PLATE I

SEISMIC & SAFETY ELEMENTS

of the

RESOURCES PLAN & PROGRAM

ventura county planning department october 1974

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october 1974

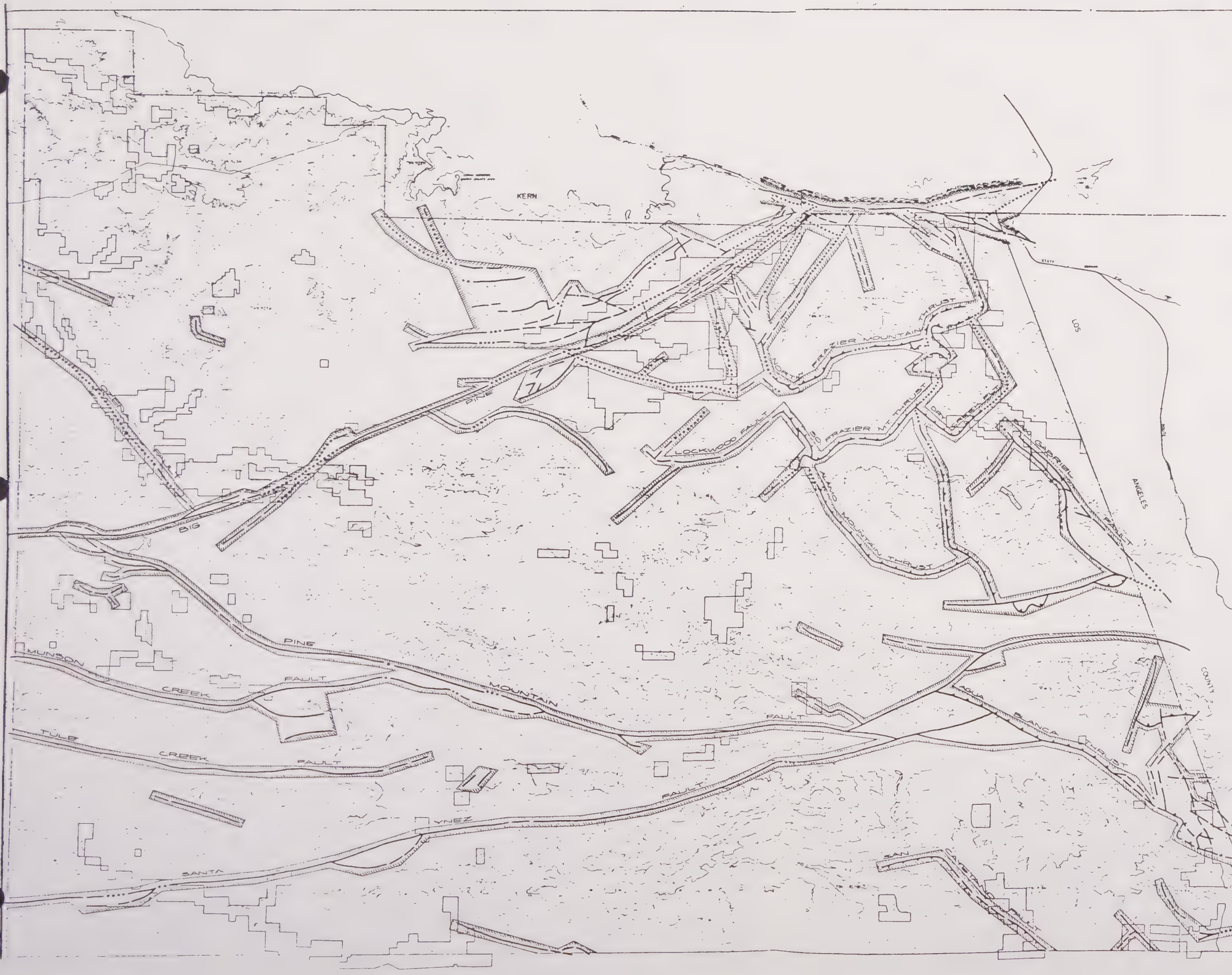
MAP OF

THE NORTH HALF OF

VENTURA COUNTY

CALIFORNIA

GENERAL COUNTY MAP



FAULT HAZARD ZONES

- PRIMARY ZONES WHICH CONTAIN FAULTS WHICH HAVE BEEN ACTIVE DURING HISTORIC OR HOLOCENE TIME
- SECONDARY ZONES WHICH MAY CONTAIN ACTIVE OR POTENTIALLY ACTIVE FAULTS

NOTE ZONE BOUNDARIES ARE APPROXIMATELY LOCATED

EARTH FAULTS

- POSITIVELY IDENTIFIED
- RELATIVELY WELL-IDENTIFIED AND/OR RELATIVELY ACCURATELY LOCATED
- CONCEALED
- "TOOTH SYMBOL" DENOTES THRUST FAULT; TEETH ARE DRAWN ON THE UPPER PLATE, DOWN-DIP SIDE OF FAULT

SOURCE CALIF. DIV. OF MINES & GEOLOGY
VENTURA COUNTY DEPT. OF PUBLIC WORKS

GROUND SHAKING

Description

By far the greatest damage from an earthquake is caused by the shaking of the ground. When an earthquake occurs, the break along the fault plane begins in a small area (the earhtquake focus) and rapidly propagates out along the fault planes. As it breaks, the accumulated strain energy is released as seismic waves, which travel outward in all directions from the earthquake focus. Several kinds of motion are created by the passage of seismic waves, as indicated by seismograms (records of earthquake motion).

Seismic waves change in speed and wave amplitude as they pass through different materials. For example, they have a higher speed and lower amplitude in bedrock than they have in water saturated sediments. An increase in wave amplitude generally means an increase in the intensity of ground shaking.

When buildings and the ground on which they rest approach the same vibration period, the greatest damage is likely to occur. Taller buildings in general are more flexible and have a longer vibration period. Therefore, they are subject to greater damage where they occur on ground with a longer predominant vibration period (such as water-saturated sediments). Other factors which contribute to damage potential, such as magnitude, distance, frequency and duration of a particular earthquake, influence the predominant vibration period. In general, the greatest damage is likely to occur where the predominant ground period is coincident with the greatest number of high occupancy buildings.

Ground shaking can also trigger ground failure such as landsliding, and lead to differential settlement, subsidence, ground cracking, ground lurching, and a variety of transient and permanent changes in the ground surface.

The probability of an earthquake is determined by a number of factors, but basically by the location of active faults in an area and the tension and compressional forces exerted against these faults. There are several major fault systems which transect the county from east to west, and the main branch of the San Andreas Fault runs through the extreme northeast corner of the county. The county is also subject to compressional forces acting in north-south directions. Most of Ventura County can be subject to as strong earthquake shaking as can be expected anywhere in California, particularly in the Oxnard Plain and the Santa Clara Valley, which would be subject to long-period shaking.

Effects

The primary effect of ground shaking is the damage or destruction of structures and infrastructures and thus the potential for the loss of life or sustaining injuries. Damage to structures during ground shaking can range from minor cracking of plaster to total collapse and/or overturning. No structure can be assured to be designed and constructed to withstand damage from a strong earthquake. Some damage, whether it be to the structure or its contents, can be anticipated. Ground shaking could also cause severe damage to most utilities including pipelines, power lines, generating and convertor facilities, roads and bridges, if such structures are not constructed to withstand the shaking.

Possible secondary effects include cost of rehabilitation, disruption of utilities and services, seiches, liquefaction, effect on the quality of water in ground water aquifers, and psychological effects.

Alleviation of the hazard is largely accomplished through land use controls, by enforcement of the Uniform Building Code and city and county regulations.

Findings

Available geologic information indicate that the potential of strong ground shaking occurring over much of the county, as a result of an earthquake along one of the major faults within the county, is high when compared to other areas of the state. In the event of a strong earthquake originating in the vicinity of the southern county area or a major earthquake along the San Andreas Fault, damage to many existing structures could be severe and some loss of life could occur.

The effects of the hazard can be reduced by prudent location and design of proposed important structures and vital facilities and determination of which such existing structures and facilities should be strengthened, replaced or modified in use.

Schools, commercial and industrial areas, residential areas, rest homes and other public building and vital facilities are affected by zones of varying severity of potential ground shaking. In general, the urbanized areas are located within the zones of greatest amplification of long period vibrations.

The conclusions are based primarily upon historic experience as well as considerable scientific research which has been conducted since the 1971 San Fernando Earthquake. The hazard zone boundaries must be considered approximate and subject to change as more detailed information becomes available.

POTENTIAL AMPLIFICATION OF GROUND SHAKING

A — long period—greatest

B — long period—slight to moderate

C — short period—greatest

D — short period—slight to moderate

E — relatively low

SOURCE: VENTURA COUNTY DEPARTMENT OF PUBLIC WORKS

HAZARDS PLATE II

SEISMIC & SAFETY ELEMENTS

of the

RESOURCES PLAN & PROGRAM

ventura county planning department october 1974

MAP OF

THE SOUTH HALF OF

VENTURA COUNTY

CALIFORNIA

GENERAL COUNTY MAP

HAZARDS PLATE II

SEISMIC & SAFETY ELEMENTS

of the

RESOURCES PLAN & PROGRAM

ventura county planning department may, 1974

october 1974

MAP OF

THE NORTH HALF OF

VENTURA COUNTY

CALIFORNIA

GENERAL COUNTY MAP

POTENTIAL AMPLIFICATION OF GROUND SHAKING

- A LONG PERIOD-GREATEST
- B-C SHORT PERIOD-GREATEST
- D SHORT PERIOD-SLIGHT TO MODERATE
- E RELATIVELY LOW

SOURCE: VENTURA COUNTY DEPARTMENT OF PUBLIC WORKS

PRIVATE LANDS WITHIN NATIONAL FOREST

FLOODING

DESCRIPTION

A flood may be defined as a temporary rise in stream flow or stage that results in water overtopping its banks and inundating areas adjacent to the channel. The area subject to inundation is generally referred to as the flood plain. The size and frequency of occurrence of a flood in a particular channel depends on a complex combination of conditions, including the amount, intensity, and distribution of rainfall, previous moisture conditions, and drainage patterns.

The magnitude of a flood is measured in terms of its peak discharge, which is the maximum volume of water passing a point along a channel. However, floods are usually referred to in terms of their frequency of occurrence, which is related to discharge; for example, the 100-year flood for a particular channel is the size flood which has a probability of being equaled or exceeded once in 100 years. The magnitude of the flood selected by a governmental agency for planning purposes (usually 50-year or 100-year) is referred to as the selected or regulatory flood.

Flooding is a natural occurrence, with some long range beneficial aspects such as replenishment of sand to beaches and of nutrients to agricultural lands. It is a hazard only because people find flood plains a desirable place to live and use. Man's encroachment on flood plains can also increase the hazard: structures may obstruct the flood flow, thus increasing flood heights, and the covering of the ground with impervious surface (e.g. pavement) increases the rate and quantity of runoff.

All water courses could at sometime be subject to flooding. The major channels in Ventura County which could present a hazard to existing development include the Santa Clara River, the Ventura River, Calleguas Creek, and some of the major tributaries of these rivers.

EFFECTS

The primary effect of flooding is the threat to life and property. People and animals may drown; structures and their contents may be washed away or destroyed; roads, bridges, and railroad tracks may be washed out; and crops may be destroyed. The amount of damage caused by a flood depends on the depth of inundation, the velocity and duration of the flood, the debris production of the watershed, and the erodibility of the bed and banks of the watercourse.

Much of the property damage from floods is caused by the severe erosion which results from fast-moving flood waters. Floating debris and sediment caused by floodwaters can worsen the damage from flooding by obstructing flood flows and increasing the overflow area, damaging bridges and structures, damaging or plugging flood control channels, and destroying crops and creating a health hazard as they are deposited upon the land when the flooding recedes.

Floods may also create health and safety hazards due to the discharge of raw sewage or explosive or toxic materials from damaged septic tank leach fields, sewer lines, sewage treatment plants and storage tanks that can be carried off by flood waters. In addition, vital public services may be disrupted.

A major secondary effect of flooding is the cost to local and national taxpayers from evacuation, relief, and floodfighting services, cleanup operations, and the repair of damaged public facilities. Taxpayers must also share the cost of low interest disaster loans, and fund flood control facilities to protect development from future floods.

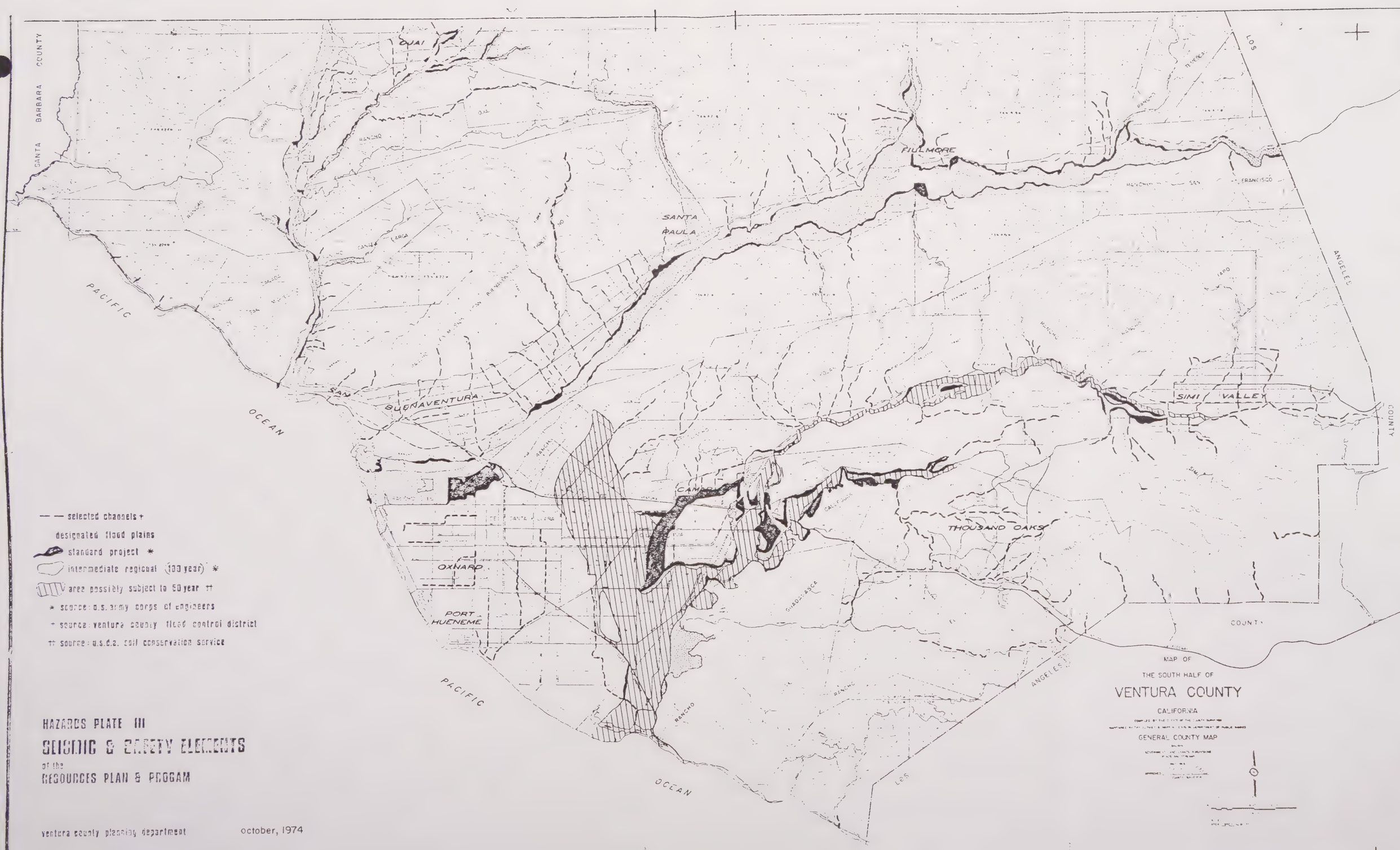
The flood hazard may be alleviated through a variety of measures, including corrective measures such as flood control works, and preventive measures such as flood plain management, which regulates the types of activities permitted in flood hazard areas.

FINDINGS

Floods are natural occurrences whose frequency and magnitude depend on rainfall and drainage patterns. It can be expected that the flood plain will probably be completely inundated on the average of once every 100 years.

Several areas in the county are subject to serious flooding. Past floods indicate that loss of life, property damage and loss in economic production could be extensive. Located within the 100-year flood plain of the Ventura River and the Santa Clara River are residential areas such as portions of Live Oak Acres and Casitas Springs. The remaining unincorporated areas are in agriculture or open space uses. Along the Calleguas Creek flood plain, besides agriculture and open space uses, are two schools and a sewage treatment plant.

The most appropriate uses for flood plains are open space uses, such as green belts, parks, and some types of agriculture. Where development is permitted, however, it should be controlled through more specific and stricter regulations than now are in effect.



HAZARDS PLATE III

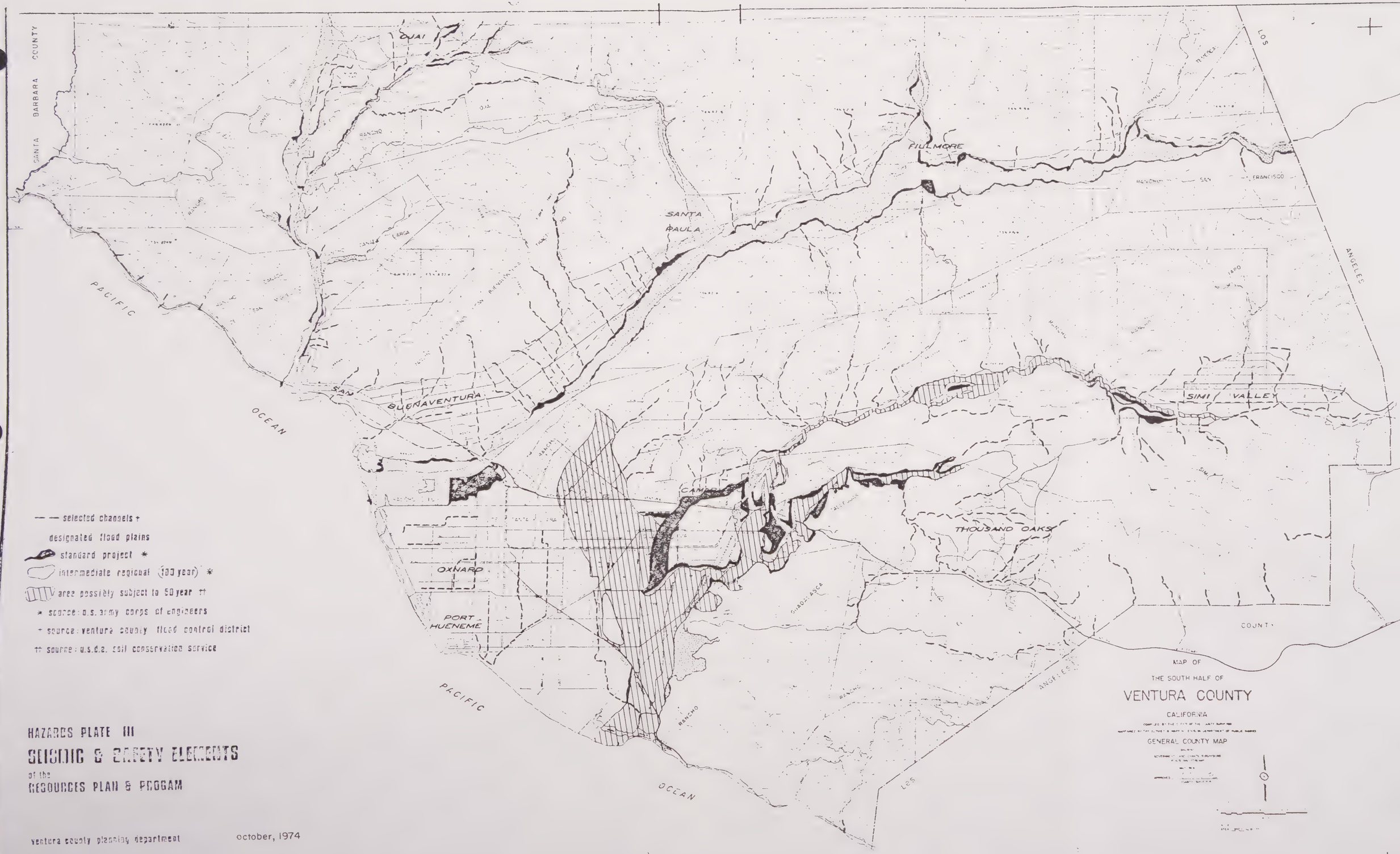
SEISMIC & SAFETY ELEMENTS

of the

RESOURCES PLAN & PROGAM

MAP OF
THE SOUTH HALF OF
VENTURA COUNTY
CALIFORNIA
GENERAL COUNTY MAP

ventura county planning department october, 1974



— — selected channels +

designated flood plains

standard project *

intermediate regional (100 year) *

area possibly subject to 50 year ††

* source: u.s. army corps of engineers

\+ source: ventura county flood control district

†† source: u.s.d.a. soil conservation service

MAP OF
THE SOUTH HALF OF
VENTURA COUNTY
CALIFORNIA
GENERAL COUNTY MAP

HAZARDS PLATE III

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october, 1974

LANDSLIDE/MUDSLIDE

GENERAL DESCRIPTION

All hills, mountains and other highlands are being worn down by various natural processes. The most spectacular of these is the landslide, along with other related types of ground failure. The processes are referred to geologically as "mass wasting," defined as the en masse downslope movement of rock debris. There are numerous causes of mass wasting, including erosion, water, broken or weak bedrock, earthquakes and unsound engineering practices. Most landslides are caused by a combination of 2 or more of these factors, and come in a number of forms.

Landslides can range from a rock fall, which is the movement of a mass downslope without serious disturbance to the surface it moves over, to a flow, which generally is saturated or nearly saturated unconsolidated material that undergoes viscous flow, and can spread over wide areas and move greater distances than other landslides because of its great plasticity. Also included are slumps and blockglides, which are types of ground failure which involve movement of both the soil and subsoil surface.

The speed with which landslides occur can vary considerably from rapid downfalls to virtually imperceptible movements downslope under the pull of gravity. Soil creep, occurring mainly in clayey soils, is a very slow type of earthflow movement.

Man-made cuts or excavations can undercut unstable slopes, thus causing landslides. Man-made slides may occur during grading operations or after grading operations in hillside development. Those that occur during grading operations are generally not as hazardous nor as expensive to repair as slides that occur after development.

In general, most landslides within the county are shallow, ranging up to perhaps 100 feet in depth and limited in extent, generally less than 100 acres. Most are not presently in motion (active) but have moved down to positions of stability. However, the margin of stability of most landslides is small and inadequate for safe placement of structures on the surface of the landslide.

Many of the existing landslides can be reactivated and downslope movement renewed after exceptionally heavy rainfall periods or as a result of earthquake shaking. Generally, the renewed movement of old landslides is slow, perhaps only a few inches day. However, the formation of a new landslide can be rapid with initial, often quite sudden movements of hundreds of feet within a few hours.

Landsliding and slope instability is found throughout the mountainous and hilly areas of Ventura County. The highest propensity for landsliding is generally located in southern Ventura County, because of its high intensity of folding and faulting of

strata, clay content of certain sedimentary formations, and prevalence of subsurface moisture.

EFFECTS

In general, the differential subsidence of the surface of landslides as well as the lateral forces exerted by most landslides can destroy most engineering structures. Primary effects of landsliding can include lateral displacement of hillside surfaces, description of surface drainage, blockage of channels and roadways, and displacement and damage to utility lines, roadways, buildings, oil and water wells, ect.

Secondary effects of landslides can include impacts such as persons and families displaced, possible loss of life, damage to nearby property, ect. Other effect could include blockage of transportation routes, disruption of utility services, loss of usable land area, ect. In addition, damage suits can be initiated against original developers of the property affected by landsliding, as well as the present owners and the government agency which may have issued the grading and/or building permits.

Most structures cannot be economically designed to withstand the forces of landsliding. Mass grading techniques, when feasible, have proven to be the most effective means of stabilizing landslides and unstable hillsides. Land use controls and the enforcement of strict subdivision, building and grading codes can in sure that incompatible and/or improperly designed development does not take place in landslide areas.

FINDINGS

Landsliding can be considered a major hazard in any hillside area, and the hilly and mountainous areas of Ventura County provide no exceptions. Most of the destructive landslides in adjacent more urbanized counties with similar terrain have resulted from the indiscriminate development of sloping ground or creation of cut and/or fill slopes in areas of unstable or inadequately stable geologic conditions. Most of the failures could have been prevented by recognition of potentially unstable conditions through adequate investigation and incorporation of design safeguards prior to grading or construction.

The hazard from landsliding is considered to be real within the developed areas of the county which were developed prior to present day grading and building codes. The level of hazard cannot readily be determined without detailed investigation of individual sites, which is considered to be the responsibility of the individual property owner.

Since the primary urban land use within hillside areas is residential, the hazard primarily impacts dwellings and associated utilities. The level of hazard is unknown as geologic information of sufficient detail for specific developed areas is not available.

BEACH EROSION

Description

The beach is an ever-changing entity, continually adjusting to changes in waves, currents, tides, and sediment deposition. These agents create a flow of sand along the coastline known as the littoral drift. Beaches remain stable only when the amount of sand deposited is equal to the amount of sand taken away both of which are determined primarily by the littoral drift. Since these two factors only rarely negate each other exactly, beaches are usually receding or advancing at any one point in time.

Sandy beaches in Ventura County are formed largely by the weathering of inland rocks and riverine transport to the sea. Most of the sand is deposited along the coast after major floods. It travels with the littoral drift from north to south, terminating at the sandsinks of the Mugu and Hueneme submarine canyons.

During periods of increased wave activity, such as caused by storms, the waves pounding the beach can cause the coastline to dramatically recede, since more sand is taken away than is deposited. The beaches can also change in response to tidal fluctuations, and generally advance in the summer months, when wave activity is moderate, and recede during the rest of the year in response to increased wave activity. Even longer cycles of beach erosion can be correlated with weather cycles of about 25 to 30 years.

Like nature, man has the ability to alter the configuration of the shoreline. The construction of groins, jetties and breakwaters can trap littoral sand and build beaches out over a certain area and possibly cause short-term erosion in other areas. Localized erosion problems may also ensue from the removal and/or alteration of natural protective barriers such as sand dunes, by leaving the beach more susceptible to erosion. Long-term, general states of erosion can result from human activities which have permanent effects on the amount of sand which flows to the beaches. Urbanization in the flood plains can decrease the amount of sediment produced by erosion. Stream development demanded by urbanization, such as water-inpounding dams and debris basins, can withhold significant amount of sediment from the beaches. Since 1948, water impounding dams have cut off approximately 37% of the total amount of sediment-producing watershed in Ventura County, and this blocked portion produces the most sediment. In addition, dams reduce peak velocities, which thereby decreases the ability of floods to carry sediment. The occurrence of large floods such as the 1969 floods could offset the impact of dams in the short term. However, in the long run their effects will inevitably become apparent.

Effects

Man, in his eagerness to be close to the water, loses sight of the fact that land comes and goes, and that land which nature provides in a given period may later be reclaimed by the sea. The end result is the direct destruction of homes and property as foundations are undermined by the advancing sea and strucutres and their supportive facilities are attacked directly by waves whose force is no longer dissipated by wide beaches.

The secondary effects of beach erosion include increased susceptibility to coastal flooding, direct flushing of septic tank effluent into the ocean, and loss of recreation beach when the erosion is long-term. Also taxpayers pay for street and utility damage, fund rescue and clean-up operations, and are called upon to spend large sums on erosion protection measures to avert further disaster.

Erosion hazard can be alleviated with structural measures such as groins and seawalls, but each has its disadvantages. The most complete and long lasting solution to the hazard is to manage land uses within the hazard zone and also within the flood plains, to reduce the damage potential to development and also the effects of development on beach sand supplies.

Findings

Beach erosion occurs over varying time spans with varying rates of incidence. There can be short-term, rapid erosion from storms, seasonal and tidal fluctuations, and cycles of 25 years or so. Short-term erosion can be man induced, as from groins and jetties. There are also long term, general trends of erosion which can have human origins. A general erosional trend at county beaches may become dominant in the future because of the possible effects of increasing urbanization on the supply of sand to the coast.

Beach erosion occurs with varying degrees of severity. Storms can cause the coast to rapidly recede many feet. Net long-term trends may be indiscernable in the short run, but over the long run can have catostrophic effects when they result in the erosion of many feet of beach over a long period of time. Erosion severity usually varies from place to place along the coast at any one point in time.

In the unincorporated areas, residential structures and supportive facilities comprise the major resource affected by beach erosion. Erosion can undermine structural foundations, and allow waves to batter the structures themselves. More detailed information is needed to establish more specific hazard zones sensitive to local conditions, and anticipate future erosion with more accuracy.

AIRCRAFT ACCIDENTS

DESCRIPTION

Although the greatest danger in aircraft accidents is to the occupants of the plane, they also affect the area impacted. If a pilot has engine failure or for some reason must abort his flight, he would normally attempt to direct his craft away from structures and land in a clearing. If no such area exists, however, he has no choice but to impact a structure at which death, injuries and property damage may result.

Aircraft accidents have a variety of causes; some are due to mechanical failure, but most are due to pilot error. Although some accidents may be prevented by restricting building heights and smoke or placing distracting lights on the ground it is not possible to completely eliminate them. Everytime an aircraft takes off or lands, there is the potential for an accident.

An accident can occur at any stage of a flight; however, analyses of accident data have shown that most occur in the vicinity of airports (about 62% of all aircraft accidents occur within one mile of the airport). Also, 60% of all "near-airport" accidents occur within narrow bands at the ends of the runway; most near-airport accidents occur in the initial climb or final approach phase of the flight. It is during these critical transition periods that both the pilot and aircraft are under the greatest stress. The approach and departure flight patterns of an airport therefore provide an indication of the ground area subject to the greatest hazard.

Aircraft accidents are a relatively rare occurrence. A nationwide survey shows that there were 1.38 accidents per million operations at controlled airports. In 1972 and 1973 there were 15 civilian aircraft accidents in Ventura County for approximately 700,000 operations over the two years, which were near or on airports, seven were at Santa Paula and seven at Santa Susana Airports. The other accident occurred a little over a mile from the County Airport.

EFFECTS

The primary effects on the ground from aircraft accidents are injuries to people and damage to property in the area of impact. The severity of accidents varies greatly, depending on the weight, speed, and fuel load of the aircraft. The amount of destruction resulting from an accident also depends on the land use in the impact area. Fewer lives would be threatened by a crash into a single-family home than by a crash into a school.

Also, a secondary effect of the hazard might include a fear of aircraft accidents by residents in areas under flight patterns, possibly reflected in a decline in residential land values near airports and pressures from residents to end or restrict airport operations.

No matter what safety precautions are taken, there will always be occasional accidents near airports. The only way of alleviating the hazard to people on the ground is to keep them out of the area. This may be accomplished through careful land use planning, which is the responsibility of the County Airport Land Use Commission and local government.

FINDINGS

Accidents occurring in the vicinity of airports are rare. There is a 20% probability of an accident occurring at the Ventura County Airport over a year's span, based on national statistics. The potential for an accident exists with every operation, but the probability is affected by the number and type of operations, weather and topography of the area and the surrounding land uses.

Existing land uses in the county within the hazard zone are primarily in agriculture and open space, and therefore few people or structures are found within the zone. Continuance of these uses in hazard areas will keep the severity of a potential accident to a minimum.

The hazard boundaries were defined through the use of national accident data and analysis of aircraft operations. More precise hazard areas could be determined through analysis of each airport, and the conditions specific to each in terms of types of operations, weather conditions, and other factors.

SANTA BARBARA COUNTY

OJAI

PACIFIC OCEAN

SAN BUENAVENTURA

SANTA PAUL

FILLM

SIMI VALLEY

VENTURA COUNTY

CAMARILLO

THOUSAND OA

RANCHO EL RIO

SANTA CLARA

OXNARD

PORT HUENEME

PACIFIC OCEAN

exist. landslide zones*

landslide / mudslide hazard zones*

high

intermediate

little or no

active beach erosion**

Aircraft Accident Hazard Zone

* Source California Div. of Mines & Geology

** Source Ventura County Dept. of Public Works

HAZARDS PLATE IV

SEISMIC & SAFETY ELEMENTS

of the

RESOURCE PLAN & PROGRAM

ventura county planning department october, 1974

MAP OF

THE SOUTH HALF OF

VENTURA COUNTY

CALIFORNIA

GENERAL COUNTY MAP

LIQUEFACTION

DESCRIPTION

By far the greatest threat from an earthquake is the ground shaking that is produced and the resulting direct and indirect effects on man-made structures. In some earthquakes ground shaking results in ground failure, which can have catastrophic effects on structures. Ground failure is most often caused by liquefaction, and can occur on relatively level ground.

Liquefaction can occur when loose, cohesionless, uniform soils saturated with water are subject to ground shaking of sufficient intensity and duration. Liquefaction can be manifested by a range of phenomena, including landslides which can move hundreds of feet, and the development of temporary quicksand-like conditions over substantial areas. The quicksand-like conditions can cause buildings to sink substantially or tilt into the ground, and lightweight buried facilities to float to the surface.

When a saturated sand is subjected to the necessary amount of ground shaking, it tends to compact and decrease in volume; if drainage cannot occur, the decrease in volume increases the pressure of the contained water. If this pressure reaches a point equal to pressure applied from above, the sand looses strength completely, and develops into a liquified state.

Liquefaction can occur at any level of a deposit but usually occurs within the first 40-50 feet. The potential for liquefaction exists wherever there are saturated, loose sand deposits, especially if they are near the surface. In Ventura County, most of the river valleys are susceptible to liquefaction, and most of the Oxnard Plain as well.

EFFECTS

Liquefaction can cause structures to tilt or settle into the ground surface, and possibly collapse if the structures are not designed to resist the imposed stress. These effects are usually associated with liquefaction occurring in surface or near-surface soils, which decreases the foundational support of buildings lying within the liquified zone. Generally, the larger the structure, the greater its potential for settling through liquefaction during an earthquake. Smaller buildings such as single family frame homes are not likely to suffer major damage except in situations where the water table is less than fifteen feet from the surface. Larger buildings, if not designed against liquefaction, can be severely affected, even if anchored down to forty to fifty feet below the surface. In addition, light sub-surface structures such as pipelines and storage tanks can float to the surface during the ground shaking, causing further damage.

When liquefaction occurs in soil layers below the surface, it is subjected to a pressure during ground shaking which is usually relieved by the flow of water and soil to the ground surface. If the flow is large, it can have the same effects as surface liquefaction by inducing a liquified condition at the surface. If the sub-surface liquefaction occurs on a slope, earthquake induced landslides can be the result, especially if the water cannot escape vertically and is forced horizontally along the contact surface. Structures built across the edges of a slide are torn apart in much the same manner as if they were located on a fault.

The secondary effects of liquefaction include the destruction or disruption of the infrastructure (i.e. gas lines, water, sewer, roads, etc.) in an area. Pipelines could be broken either by being floated to the surface or by landslide displacement. Bridge abutments could suffer differential settlement, cutting off roads. Liquefaction can cause the settlement of the soil by several feet in an instant, which can drop some areas below sea level and produce a new shoreline, and require reconstruction to re-establish continuity of roads and utility lines.

Structures can utilize special designs to alleviate the effects of the hazard. Land use controls are the only other methods to reduce the threat to life and property from liquefaction.

FINDINGS

Liquefaction has occurred in the identified hazard zone and can be expected to occur again whenever an earthquake of sufficient intensity occurs. According to many experts, a major earthquake on the San Andreas fault in Southern California is possible within the next fifty years; other smaller earthquakes are also quite likely.

The most severe hazard exists in areas of loose alluvium and high groundwater levels. The severity of the effects depends upon soil properties, the intensity and duration of the shaking and the resultant type of ground failure. Most structures in the hazard zone could be affected if general surface liquefaction were to occur. The residential areas and industrial facilities located on the Oxnard Plain, Pleasant Valley, Ventura River, and Newbury Park, included within the high hazard zone, could possibly sustain major property damage in case of general liquefaction.

The boundaries of the hazard zones are only approximations; effects of liquefaction may vary greatly within a given zone during a given earthquake. Any specific conclusions should be reached on the basis of detailed onsite soils and geologic studies. Special attention is most crucial for locating large structures and critical facilities.

TSUNAMI

DESCRIPTION

Tsunamis (pronounced soo-nom-ee) are large ocean waves that are generated by submarine landslides, volcanic eruptions or earthquakes in or near ocean basins. The waves are commonly referred to by the general public as tidal waves.

These waves have a long wavelength (distance from the crest of one wave to the crest of the succeeding wave) normally over 100 miles, and a very low amplitude (height from crest to trough). Approaching shallow water, their speed decreases from a deep water speed of over 600 m.p.h. to less than 30 m.p.h., as they move across the beach. Wave energy is transferred from wave speed to wave height, forming waves as high as 100 feet.

The waves can arrive on shore in intervals of up to an hour. Since there are usually a number of waves produced in a set, the threat usually exists for as long as 10 to 12 hours. Tsunamis are sometimes preceded by a trough which frequently brings the curious down to the shore to examine what appears to be an extremely low tide. The wave itself may follow the trough by 15 to 45 minutes. Tsunamis can also travel considerable distances inland on waterways, particularly those with shallow gradients.

Although the arrival time of these waves can be predicted by international monitoring programs, such as the Seismic Sea Wave Warning System (SSWWS), the intensity of the wave once it reaches the shore cannot be predicted. The varying intensity of the waves can also result in extensive damage in one area, while causing negligible damage in adjacent areas. Tsunamis have been known to produce devastating effects at distances as much as 10,000 miles away from their origin.

All of the coastal areas in Ventura County are susceptible to tsunamis. The Channel Islands do not provide adequate protection for the county coastal areas because tsunamis can move down the Santa Barbara Channel from the north (originating from the north Pacific), the south (originating from the south Pacific) or be generated along the faults present in the Santa Barbara Channel itself.

EFFECTS

Tsunamis are a threat, not because they are so extensive or frequent, but because the destruction they cause can be devastating. The effects of the waves are confined to the immediate beach area and up to one mile inland in flat areas. The effects are most noticeable on man-made features, however, these effects are usually temporary. The waves can also make more lasting changes to river channels and coastal landforms. Structural damage in the path of a

tsunami is unavoidable, but loss of life can be avoided if the necessary precautions are taken in response to sufficient warning. The SSWWS, in conjunction with local authorities, can provide adequate warnings, unless the tsunami is generated locally, such as within the Santa Barbara Channel. In this case these waves could strike the coast in a matter of minutes.

Tsunamis can also have indirect effects which are not as easy to anticipate or visualize. Tsunamis can contaminate water systems, disrupt power, block or dislocate key transportation systems, generate fires from broken oil and gas tanks or lines, induce flooding from blocked rivers, etc.

While warning systems can alleviate loss of life from tsunamis, they cannot protect property along the coastline. Land use controls can be employed, where deemed appropriate, to reduce the possibility of property loss from tsunamis, and also loss of life where there is no time for a general warning.

FINDINGS

A tsunami threat exists to the entire county coastline. Based upon historic record, the probability of a major tsunami hitting Ventura County seems remote, but due to their unpredictable nature, a tsunami could occur at any time. The last major wave struck the county in 1812, but minor tsunamis have been recorded as recently as 1964.

Historic records in Ventura County (and throughout the world) reveal that the severity of tsunamis vary greatly, but that a major tsunami could cause extensive damage within the designated hazard zone and possible loss of life if the warning system is inadequate.

In the event of a major tsunami, loss of life and property damage would not be as great in unincorporated areas as in the incorporated cities. Nevertheless, numerous small coastal communities could be affected as would many oil production and storage facilities, and vital transportation links.

The validity of conclusions arrived at in this study of tsunamis is a function of the information from which they were derived. It should be noted therefore that while local data is limited, it does provide a basis for making general indications of the areas that would be affected by a major tsunami and that damage would occur.

SEICHE

DESCRIPTION

A seiche (pronounce sāsh) is a wave or series of waves or oscillations, set up in an enclosed or partially enclosed body of water by wind, earthquake or landslide.

In a large body of water, wind can set up an oscillation that will send waves above the normal waterline. This type of seiche usually occurs only when the body of water is located in an unusual position in relation to local wind patterns.

The most common seiches are set up in lakes and bays, either directly or indirectly by earthquakes. The shaking of an earthquake can set up large and destructive oscillations that can send waves tens of feet above normal lake level. Indirectly, tsunamis, by causing a rapid change in sea level or more commonly by the wave itself, can set up smaller internal oscillations in bays and harbors. Fault displacement can either displace a quantity of water or tilt the lake bed suddenly, producing waves by either effect. Landslides, whether triggered seismically or in some other manner, can be the most destructive type of seiche because of the massive waves they are capable of producing.

The hazard exists in all the lakes in the county, the two marinas and the harbor. The lakes that are impounded by earth-fill dams could have the greatest hazard potential (Lake Bard, Lake Piru and Lake Casitas) due to the possibility of the waves over-topping the dam and washing out. The Santa Clara River Valley could be affected by seiche caused dam failure on Castaic or Pyramid Reservoirs.

EFFECTS

The primary threat from a seiche is to structures and facilities very near a lake, harbor or bay, such as boats, wharves, campgrounds and buildings. The secondary effects of a seiche can often produce more damage than the seiche itself, and pose a significant threat to life. Large seiches can over-top the dams of man-made lakes and reservoirs, causing flooding in the areas downstream. This over-topping can also wash out earth-fill dams, causing their complete collapse.

The duration of seiches is usually on the order of only a few minutes, unless generated by a tsunami lasting several hours. Their extent is usually limited to about 10 or 20 feet above the water level, however, a landslide can displace a wave that could travel hundreds of feet up the opposite shore of a body of water.

There is no way to alleviate the effects of possible seiches except by prohibiting construction within the harzard area. The hazard could also be minimized by restricting development which could promote landslides into water bodies subject to seiche.

FINDINGS

A hazard from seiches does exist in the county, but the threat is considered remote. Only facilities in or very near, enclosed bodies of water could be immediately affected. The over-topping of dams by seiches, however, could cause significat adverse effects down-stream.

liquefaction potential*

high – water table less than 15' from surface

moderate – water table 15' to 40' from surface

water bodies subject to seiche~

tsunami hazard zone~

source:

* ventura county department of public works

~ ventura county planning department

HAZARDS PLATE V

SEISMIC & SAFETY ELEMENTS

of the

RESOURCES PLAN & PROGRAM

prepared by

ventura county planning department

october, 1974

MAP OF

THE SOUTH HALF OF

VENTURA COUNTY

CALIFORNIA

GENERAL COUNTY MAP

SUBSIDENCE

GENERAL DESCRIPTION

Subsidence, or the sinking of the land surface, is a worldwide problem. In general, there are six basic causes of subsidence, two natural and four the result of human actions. Natural subsidence can occur as a result of the normal settling of the ground, or as a result of tectonic forces such as down warping. Man-related causes are associated with: ground water withdrawal, oil or gas withdrawal, hydrocompaction, and peat oxidation. Subsidence caused by ground water withdrawal, which generally occurs in valley areas underlain by alluvium, is the most extensive type of subsidence and has the most costly impacts. Of the six causes, all but peat oxidation may be associated with subsidence in Ventura County.

The process by which subsidence caused by ground water withdrawal occurs basically involves the substantial or initial (first time) extraction of water from an unconsolidated artesian aquifer. As the water is removed from the aquifer, the total weight of the material above it (the overburden) which the water used to help to support is placed on an alluvial structure. If such structures are unconsolidated, they can be compressed, resulting in subsidence.

If fine-grained silts and clays make up a portion of the aquifer, the additional load caused by the withdrawal of water and its support can squeeze the water out of these layers and into the coarser grained portions of the aquifer. All of this compaction produces a net loss in volume and hence a depression in the land surface. A very similar sequence of events leads to subsidence with oil and gas withdrawals.

Subsidence also can and does occur as a natural process. It can result from the settling of geologically new sediments and downwarping which accompanies crustal folding. Perhaps the most hazardous type of natural subsidence is that which might be caused by seismic shaking. Liquefaction of fine-grained materials during an earthquake would cause a loss of ground support and the surface could consequently settle very rapidly.

A very significant area in Ventura County is experiencing subsidence. This area includes the entire Oxnard Plain and extends up the Santa Clara River Valley. Records up to 1968 show a dozen benchmarks in this area that have settled about a foot in a fifteen to twenty year period. Four possible causes of subsidence in Ventura County have been cited: natural consolidation of alluvium, tectonic deformation, water extraction, and/or oil extraction.

EFFECTS

Subsidence which results from ground water withdrawal can be responsible for damage to various types of structures. Those most

seriously affected are long surface infrastructure facilities which are sensitive to slight changes in gradient. Within this group are: wells, canals, sewers and drains which have experienced functioning and structural failures. In a 1970 projection, losses to the year 2000 were estimated to reach $26,000,000 for subsidence in California, water withdrawal subsidence accounting for a large part of this.

Subsidence caused by oil and gas extraction is similar in effect to that caused by water extraction. In one example, oil extraction was responsible for $100,000,000 in damages to various facilities and structures in the Long Beach area.

Subsidence has the secondary effect of leaving an area more susceptible to damage from coastal and river flooding, by allowing water to flow more easily into low areas further depressed by subsidence. Also, beach erosion can increase as a result of the subsidence of coastal areas. Another secondary effect is that services can be disrupted with damage from subsidence to facilities such as canals, sewers, wells, pipelines and drains.

If human activity, such as the extraction of fluids, is determined to be the cause of subsidence, then regulatory measures such as providing surface water to areas with dropping ground water tables could halt the subsidence. However, if natural processes are responsible, control is much less easily exercised assuming it is even possible.

FINDINGS

A subsidence problem in the county does exist, mainly in the Oxnard Plain. It is probable that it will continue, possibly at an increasing rate if extraction of fluids from this area is increased.

Measurements to date indicate that a maximum drop on the order of 1.5 feet has occurred over the past 20 years in some areas of the Oxnard Plain. Further surveying is continuing and should better define the magnitude of this problem.

Property damage due to subsidence can and does occur over a long period of time. Loss of life would occur only as a secondary effect of subsidence, say as the result of flooding. Drainage courses, wells and utility lines are potentially the most vulnerable to damage.

A possibility exists that some potential subsidence damage can be controlled. However, little can be done until a more detailed determination is made of the cause or causes of subsidence, as well as its rate.

EXPANSIVE SOILS

GENERAL DESCRIPTION

Expansive soils are those which are clayey, expand or swell when wetted and contract or shrink when dried. Wetting can occur in a number of ways: absorption from the air, ground water fluctuations, lawn watering, broken water or sewer lines, etc.

The expansion of soils can exert tremendous force. As an expansive soil expands and contracts it tends to move downslope in response to gravity. This produces downslope soil creep in hillside areas, and is the only area subject to expansive soils which must continue to receive special attention in Ventura County. The hazard is scattered throughout Ventura County, and merits soil tests at each specific site to detect it, because of its localized nature.

EFFECTS

These soil movements can cause structural damage to houses, buildings, roads, pavement, pipelines, reservoirs, swimming pools, canals, and utilities of all types. It can happen in two ways. First, the expansion of the soil can cause it to heave and thus place direct pressure on a structure. Alternatively, soil expansion can lead to the loss of support under part of a structure. This can occur during swell conditions if the saturated soil shifts due to the weight of the structure, or in dry conditions if the soil shrinks and support is withdrawn.

Damage to houses can range from the impaired functioning of doors and windows through plaster and foundation cracks to total destruction in extreme cases. Often water from a leaking sewer line is responsible for causing the soil expansion which damages a home.

The main secondary effect of expansive soils to structures not designed against the condition is monetary loss, and the problems associated with blighted housing - vacancies, vandalism, lower property values in adjoining areas.

Various foundation construction techniques and special engineering designs can alleviate the hazard. Soil tests to measure the degree of expansiveness are used to reveal the type of corrective measures needed.

FINDINGS

Soils of varying degrees of expansiveness can be found throughout most of the county. With the county's seasonally rainy/dry periods, it can be assumed that local soils will have the opportunity to shrink or swell if they have significant clay content.

Historically, expansive soils have caused considerable damage in Ventura County. The damage has occurred to homes shortly following their construction. Since the initial damage was done, however, the problem has been studied and corrective construction techniques have been developed. This has allowed construction even in areas where the hazard is severe. Through proper investigation and design, the potential for damage can be eliminated.

Basically, the information is available to protect property from damage caused by expansive soil. Soil tests can reveal if a problem exists and, if it does exist, the degree of hazard can be defined. Proper foundation construction can prevent damage if a threat is shown to be present. Therefore, the only action necessary to prevent damage from expansive soils is a process which requires the appropriate information be developed and applied to the specific site. Expansive soils are generally localized in occurrence, so relying on the designation of hazard zones on a county-wide basis is usually not adequate for purposes of providing protection.

EXPANSIVE SOIL ZONES

high

moderate

low

PROBABLE SUBSIDENCE ZONES

approximately 0.05'/yr.

less than 0.05'/yr.

estimated limit

HAZARDS PLATE VI

SEISMIC & SAFETY ELEMENTS

of the

RESOURCES PLAN & PROGRAM

ventura county planning department

october, 1974

SANTA BARBARA COUNTY

LOS PADRES NATIONAL FOREST BOUNDARY

PACIFIC OCEAN

SAN BUENAVENTURA

SANTA PAULA

FILLMORE

SIMI VALLEY

CAMARILLO

OXNARD

PORT HUENEME

PACIFIC OCEAN

COUNTY

MAP OF

THE SOUTH HALF OF

VENTURA COUNTY

CALIFORNIA

GENERAL COUNTY MAP

FIRE

Description

In Ventura County, the climate is warm and dry, with gentle winter rains and clear summer skies. The golden hills and mountains, with brush and oaks at low elevations and pine forests at the ridge tops, provide spectacular views and recreation opportunities all year long. However, these same amenities make Ventura County one of the most hazardous fire areas in the country.

The climate in this area is generally referred to as "mediterranean", with rainfall concentrated in the most efficient months, during the cool winter when there is less evaporation. These winter rains are stored in the ground and in the vegetation to assist it over the summer drought, which is the dominant characteristic of this climate. It begins usually in May and often lasts into November.

A local weather variation which aggravates the already fire hazardous situation is the Santa Ana winds. The dryness which they bring from desert areas desiccates the vegetation with a thick layer of dead material, extreme dryness, and high winds to provide oxygen. The resulting fire can spread very rapidly, particulary on steep hills which frustrate fire suppression attempts.

Effects

In the short run, fire has its most widespread effects on the natural environment. However, in some ecosystems wild fires in the longer run are actually beneficial. The chaparral associations contain large number of plants that require fire to produce or thrive, and when these associations burn they are actually improved.

Damage to man-made improvements account for most of the dollar loss from wildfires. Developments in hillside areas are all to often located in dangerous brush covered area, and built with flammable materials. Ofther facilities are also affected, such as high tension power lines and other utilities and facilities located in the hazard zone already dried by the summer drought.

Southern California's natural vegetation has adapted to this summer drought cycle. Grass and wildflowers, the annual plants, pass through the active phases of their life cycles in early spring and go to seed and die in early summer, leaving dry material which increases the fire hazard. The perennial plants, such as the sage, shed a portion of their leaves during summer drought and develop waxy coating on leaves to cut down evapotranspiration. Unfortunately, these adoplations are major

contributors to the extreme flammability of the Chaparral and other plant associations which cover most of the steep hills between the beach and the pine covered hilltops.

It should be noted that fire is a normal condition in Southern California. Before European settlers arrived, the vegetation became adapted to natural fires, or those set regularly by Indians to drive out game. Ironically, the longer an area goes without burning, the more fuel there is ready to burn. Thus, the more effective we are in preventing fires, the more likely they are to occur. Fires are usually ignited by man; natural causes, such as lightning, are now relatively minor causes of local fires. Although many fires are started every year, few of them actually develop into major brush fires. The optimum condition for large fires is heavy vegetation. Occasionally, homeowners are injured or killed when they do not evacuate their homes or are trapped without warning by wildfires. The largest number of deaths and injuries occurs to the fire fighters themselves.

The secondary effects of the hazard include increased mudslides and mudflows as fires remove vegetations which stabilize soil and reduce erosion from heavy rains. Public facilities are strained by fires, water supplies deleted, power lines are downed, telephone systems are disrupted, flood control facilities are clogged by the increased debris flow, and recreational areas are shut down. Some vegetational associations suffer long-term damage from fires, such as coniferous timber stands.

Findings

Fires erupt every year in Ventura County. The areas that have high brush and have not been burned for quite some time are probably the most susceptible. Most areas of high hazard have burned at least once within the last fifty years. Therefore, these areas could be expected to burn again in the next fifty years unless some method of fuel management is undertaken.

The effects of a wildfire on an area depend a great deal upon the preventive measures and recovery actions following the fire. The various fire agencies will make every possible effort to save structures during a fire but then effectiveness depends upon the preventive measures taken before the fire, such as clearing brush, installing fire-resistant roofs, keeping an adequate supply of water and providing access for fire equipment. After the fire, reseeding efforts can reduce the risk from mudslides.

Those communities located adjacent to the hazard areas could be affected but there are few facilities located in the hazard zone that are not adequately protected. There are, however, some particularly hazardous lightly populated locations that could be severely damaged in the event of a major fire.

Although the data regarding hazard zones is somewhat generalized and was compiled from older sources, it is adequate for planning purposes since the vegetation zones change very little in the long run.

fire hazard

- extreme
- moderate
- low

SOURCE: U. S. GEOLOGICAL SURVEY & CALIFORNIA DIV. OF FORESTRY

HAZARDS PLATE VIII

SEISMIC & SAFETY ELEMENTS
of the
RESOURCES PLAN & PROGRAM

prepared by

ventura county planning department

october 1974

MAP OF
THE SOUTH HALF OF
VENTURA COUNTY
CALIFORNIA

GENERAL COUNTY MAP

HAZARDS PLATE VIII

SEISMIC & SAFETY ELEMENTS

of the

RESOURCES PLAN & PROGRAM

FIRE HAZARD

EXTREME

MODERATE

SOURCE: VENTURA COUNTY PLANNING DEPARTMENT FROM AERIAL PHOTOGRAPHS

ventura county planning department oct. 1974

□ PRIVATE LANDS WITHIN NATIONAL FOREST

MAP OF

THE NORTH HALF OF

VENTURA COUNTY

CALIFORNIA

GENERAL COUNTY MAP

KERN COUNTY

LOS ANGELES COUNTY

SANTA BARBARA COUNTY

STRUCTURAL DEFICIENCIES

DESCRIPTION

The greatest single cause of lifeloss and property damage in an earthquake is the effect the shock has upon man-made structures; i.e. shattered glass, falling bricks and other materials, building collapses, etc. A major cause of such damage has been the design and construction of structures which have been unable to resist the strong lateral forces created by earthquakes. There is sufficient knowledge currently available to construct structures which can withstand fairly high lateral forces. Seismic safety can therefore be achieved through careful development and construction practices.

An understanding of the response to earthquakes of varying types of structures is essential in determining structural deficiencies. In general, unreinforced masonry, brick and concrete buildings are very susceptible to damage in earthquakes. Parapets, chimneys and other appendages are also hazardous when not properly attached or reinforced. Another indication of the possibility of hazard is the year when a structure was built, since seismic safety standards for buildings were not required or generally used until 1933, the date of the Long Beach earthquake. Upgradings of the building code have occured periodically since then.

Seismic structural safety in all buildings is attained by abating existing structural hazards in buildings, and preventing structural hazards from occuring in the future. This requires responsibility in the formulation of engineering standards and the enforcement of the standards, and the identification and abatement of the hazard in existing structures through repair or replacement.

At the present time, there is no information available on the location of structural deficiencies in the county. A brief study of a small portion of Camarillo, conducted by the Ventura County Building and Safety Department, indicated that the majority of the houses were "substandard", as defined in the housing code (which reflects many deficiencies, and not necessarily seismic safety). Nearly all of these structures were built before 1933.

EFFECTS

The primary effect of the hazard, is the loss of life and property. During an earthquake, structures are subject to the forces of fault displacement and/or groundshaking. If a structure is built directly over faults which rupture, it will inevitably be severely damaged. The effects of groundshaking, on the other hand, are not as localized, and normally extend over many miles. Also, structures can be built to resist the forces of groundshaking.

The extent of damage from the hazard covers all structures, including: buildings, utilities, gas, water and sewage lines, highway bridges and dams. The amount of damage sustained by any

particular structure is largely dependent on its condition and the intensity of the forces affecting it.

Secondary effects resulting from the damage of structures, include: the disruption of transportation, communication and power systems, and critical facilities such as fire stations, hospitals and communication centers. In times of disaster, these critical systems and facilities are essential for mitigating disaster effects. Another secondary effect is the cost of re-building. The replacement of buildings is often more expensive than when originally built. Some things can never be replaced.

Since reinforcement during construction adds only 1-2% to the cost of the project, it is not very practical to exclude sufficient reinforcements from structural design.

FINDINGS

From the evidence and the studies of geologists, it can be concluded that, the advent of a major earthquake occuring in or near Ventura County is inevitable. From the past performance of structures in earthquakes, it can be assumed that a significant hazard does exist in Ventura County. The probability of occurrence of the hazard can be reduced to a minimum through careful land use planning and adequate reinforcement of structures against seismic forces.

Should an earthquake affect the area, there could be substantial loss of lives and property. Gas, water and sewage lines could be disrupted and may be difficult to re-establish rapidly. Damage and disruption to transportation, power and communication systems, and critical facilities such as fire stations, hospitals and communication centers would increase the severity of the damage and decrease the chances for immediate disaster relief. Other facilities such as dams could have catastrophic effects if they failed.

There is a wealth of information on the ability of structures to withstand lateral forces and much of this has been documented in studies of the San Fernando earthquake. However, specific information on Ventura County's seismic structural deficiencies has not been accumulated. The findings found here are mainly based on experiences of other areas and some studies on the effects of past earthquakes in Ventura County.

The following recommendations are offered for consideration and adoption by the Board of Supervisors either acting on behalf of county government or on behalf of the Special Districts for which the Board acts as the governing board. It is recommended that:

GENERAL

1. The Board of Supervisors adopt the Seismic Safety and Safety Elements.

2. The Board of Supervisors certify the Negative Declaration for the Seismic Safety and Safety Elements.

3. In the review of proposed vital structures (such as: hospitals, schools, public services and buildings) and critical facilities (such as: power plants and water works) and facilities that could provide a substantial threat to the population (such as oil storage facilities) county staffs when applicable be instructed to require of developers any necessary information relative to hazardous conditions which may affect their proposal, and further require the developer to specify the actions intended to alleviate identified hazards.

4. All agencies involved in warning and evacuation activities be instructed to periodically review and update, if necessary, their plans and procedures in light of the hazards defined and described in these elements or any future studies.

5. The Board of Supervisors support the concept of uniform development standards and encourage county staffs to coordinate on a continuing basis with all entities within the county in the creation of such standards.

6. The Board of Supervisors direct staffs to pursue, when appropriate, further investigation of the significant hazards affecting the county, and that these investigations be done in cooperation with the other jurisdictions in the county.

FAULT DISPLACEMENT

7. The Board of Supervisors direct county staff to develop a proposal for submittal during the 75-76 budgetary process outlining the feasibility of preparing the necessary ordinances to implement

the modified policies and criteria of the State Mining and Geology Board, in the administration of Fault Displacement Special Studies Zones, as shown on Hazard Plate I. (see Option 13, page II-33)

GROUND SHAKING

8. The Board of Supervisors direct staff to pursue, when feasible, the compilation of more complete data concerning the ground shaking hazard. In the interim, the Board adopt the Hazard Zones as designated on Hazard Plate II and direct staff to utilize them for regional and local plans and special studies, and to guide future investigations of the hazard.

FLOODING

9. The Board of Supervisors direct staff to investigate and develop when appropriate, any necessary ordinances to implement the National Flood Insurance Act and to maintain the county's eligibility for National Flood Insurance.

LANDSLIDE/MUDSLIDE

10. The Board of Supervisors direct the County Planning Division to develop a proposal for submittal during the '76-'76 budgetary process outlining the feasibility of preparing a Hillside Development Ordinance.

11. The Board of Supervisors adopt the Hazard Zones as designated in Hazard Plate IV and designate staff to utilize them for regional and local plans and special studies, and to guide future investigations of the hazard.

BEACH EROSION

12. The Board of Supervisors direct all applicable agencies to:

    a. carefully consider any proposals for direct alteration of shoreline configurations, or structures which protrude into the ocean, including groins, jetties, seawalls and breakwaters; in order to determine the impacts and, if feasible, avoid or rectify said impacts.

    b. give consideration in the design of necessary flood control/water retention structures, such as dams and debris basins, to the potential effects of sand retention and other related impacts.

    These considerations should take into account the cumulative impacts of proposals and should be accomplished <u>before</u> substantial financial commitments are made.

13. The Board of Supervisors direct the Public Works Agency to consider in its proposed beach management program and encourage the Corps of Engineers to consider in its 1978 Shoreline Study the following items:

    a. the evaluation of the impacts of riverbed mining operations upon sediment transfer.

    b. the development of programs for the preservation and or stabilization of existing sand dunes, and the construction of artificial dunes where appropriate.

    c. the development of standards to be utilized in the prevention of property damage in beach erosiveness.

    d. the more thorough and specific definition of known beach erosion zones.

    e. the development of a program to monitor shoreline fluctuations on a continuing basis in order to estimate current erosion, as well as establish baseline data for future studies.

AIRCRAFT ACCIDENTS

14. The Board of Supervisors authorize Planning staff to draft interim land use guidelines relative to near-airport Hazard Zones as designated on Hazard Plate IV. Such guidelines, once adopted, shall remain in effect until such time as new guidelines are promulgated as a result of the Ventura County-Oxnard Airport Redevelopment Plan.

LIQUEFACTION

15. The Board of Supervisors direct staff to pursue, when feasible, the compilation of more complete data concerning the liquefaction hazard. In the interim, the Board adopt the Hazard Zones as designated on Hazard Plate V and directs staff to utilize them for regional and local plans and special studies, and to guide future investigations of the hazard.

TSUNAMI

16. The Board of Supervisors direct the Sheriff's Department and the Office of Disaster Services to review and update if necessary, the County Basic Plan. The Board further directs that the name of this plan be changed to: Basic Plan - Seismic Sea Wave Warning - Evacuation.

17. The Board of Supervisors adopt the Hazard Zone on Hazard Plate V and direct staff to utilize it for

study purposes. The Board further directs the replacement of the present warning area map in the County Basic Plan with the adopted hazard zone.

SEICHE

18. The Board of Supervisors adopt the Hazard Zone as designated in the Seiche hazard chapter of the Seismic and Safety Element and direct staff to utilize them for regional and local plans and special studies, and to guide future investigations of the hazard.

SUBSIDENCE

19. The Board of Supervisors support the ongoing Southern California Cooperative Level Network Program participation by the County Surveyor and direct the Planning Division to modify the present hazard zones as the leveling program progresses. In the interim, the Board adopts the Hazard Zones as designated on Hazard Plate VI and instructs staff to utilize them for regional and local plans and special studies and to guide any future investigations of the hazard.

EXPANSIVE SOILS

20. The Board of Supervisors continue to support the existing regulations and programs which are adequately dealing with the hazard. That the state of the art be continuously monitored and that existing regulations and programs be modified as conditions warrant.

FIRE HAZARD

21. The Board of Supervisors direct the Planning Division to prepare a proposal for submittal during the '75-'76 budgetary process outlining the feasibility of conducting a detailed study of fire hazard areas, based upon criteria in the National Fire Danger Rating System. This study should be undertaken in cooperation with the U.S. Forest Service and the County Fire Protection District, and should be used if applicable to identify areas to be given priority in future fuel management programs.

22. The Board of Supervisors support the Los Padres National Forest controlled burn program as a wildfire prevention tool, along with fuelbreaks and other fire prevention measures.

STRUCTURAL DEFICIENCIES

23. The Board of Supervisors direct the Building and Safety Division of the Environmental Resource Agency to prepare a proposal for submittal during the '75-'76 budgetary process outlining the feasibility of a program to evaluate

existing vital and critical facilities for their conformance to the Uniform Building Code and at the completion of that program report back with priorities for upgrading of any structural deficiencies discovered.

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